ESA Section 7 Consultation No: F/NWR/2002/01919

National Marine Fisheries Service
Endangered Species Act Section 7 Consultation
and Magnuson-Stevens Act
Essential Fish Habitat Consultation

Action Agencies: The National Marine Fisheries Service (NMFS)
The U.S. Army Corp of Engineers (COE)
The U.S. Environmental Protection Agency (EPA)
The U.S. Fish and Wildlife Service (USFWS)

Species/ESUs: Puget Sound (PS) chinook salmon *(Oncorhynchus tshawytscha)*

Actions:

1. Issuance of Permit No. 1140 - to the NMFS' Northwest Fisheries Science Center (NWFSC).
2. Issuance of Permit No. 1156 - to the Dynamac Corporation (Dynamac)/EPA.
3. Issuance of Permit No. 1309 - modification 2 to the King County Department of Natural Resources and Parks (KCDNRP).
4. Issuance of Permit No. 1315 - modification 2 to the COE Seattle District.
5. Issuance of Permit No. 1376 - modification 1 to the University of Washington, School of Aquatic and Fisheries Science (UW).

Consultation Conducted By: Protected Resources Division (PRD) of the Northwest Region, NMFS (Consultation Number F/NWR/2002/01919)

Approved By:________________ for D. Robert Lohn, Regional Administrator

Date: **April 21, 2003** (**Expires on:** December 31, 2007)

This biological opinion (Opinion) is NMFS' review of five proposed Endangered Species Act (ESA) section 10(a)(1)(A) permit actions described below, prepared in accordance with section 7 of the ESA of 1973, as amended (16 U.S.C. 1531 et seq.). This Opinion is based on information provided in the applications for the proposed permits, comments from reviewers including NMFS' Northwest Fisheries Science Center, published and unpublished scientific information on the biology and ecology of threatened salmonids in the action area, and other sources of information. A complete administrative record of these consultations is on file with the NMFS' Northwest Region (NWR) in Portland, Oregon.

CONSULTATION HISTORY

NMFS proposes to issue two new permits and three modifications authorizing scientific research studies of threatened PS chinook salmon in the Puget Sound region from the North Fork Nooksack River to the Elwha River on the Olympic Coast in the state of Washington. NMFS grouped them in a single consultation pursuant to 50 CFR 402.14(c) because the proposed actions are similar in nature and will affect the same threatened species in the Puget Sound region. The consultation history for each of the permits is summarized below.

Proposed Modifications to Existing Permits

Permit 1309 - KCDNRP

On October 10, 2000, NMFS PRD received a request from the KCDNRP for a permit to be issued to James Schroeder. NMFS issued the permit on February 20, 2002. On March 22, 2002, NMFS' PRD received a request from the KCDNRP to modify the permit for additional take of ESA-listed species and to also identify Tom Nelson as the Permit Holder. NMFS issued the amended permit on July 31, 2002. On January 13, 2003, NMFS PRD received a request to modify the permit to cover an increase in anticipated take of ESA-listed salmon, update field personnel, and authorize an additional capture method.

Permit 1315 - COE

On February 2, 2000, NMFS PRD received a request from the COE for a permit to be issued to Jeffrey Laufle. In addition, NMFS received letters from the contractors (Natural Resource Consultants, Inc. and R2 Resource Consultants) on behalf of the COE, agreeing to operate under the conditions of the permit and the permit application. NMFS issued the permit on February 22, 2002. On March 21, 2002, NMFS PRD received a request from the COE to amend permit 1315 to authorize an additional study. NMFS issued the amended permit on July 31, 2002. On December 11, 2002 NMFS PRD received a request from the COE to add an additional study to permit 1315.

Permit 1376 - UW

On March 11, 2002, NMFS PRD received a request from the UW for a permit to be issued to David Beauchamp. The permit was issued on July 31, 2002. On March 3, 2003, NMFS PRD received a request from the UW to modify permit 1376 for additional take of ESA-listed salmon. On March 6, 2003, NMFS PRD requested additional information. The UW provided NMFS with the requested information on March 10, 2003. In addition, the UW wants to extend their current permit to December 31, 2005.

Proposed New Permits

Permit 1140 - NWFSC

NMFS PRD issued permit 1140 to John Stein of the NWFSC on June 12, 1998. Permit 1140 expired on December 31, 2002. On February 7, 2003, NMFS PRD received a request from the NWFSC to renew permit 1140 issued to John Stein. On February 26, 2003, NMFS PRD requested additional information to complete the application. The NWFSC submitted a new application which addressed NMFS' questions.

Permit 1156 - EPA

NMFS PRD issued permit 1156 to Robert Hughes of the Dynamac/EPA on August 14, 1998. Permit 1156 expired on December 31, 2002. On February 14, 2003, NMFS PRD received a request from the EPA to renew permit 1156 issued to Robert Hughes.

DESCRIPTION OF THE PROPOSED PERMITS

Common Elements Among the Proposed Actions

Two of the permit modification actions considered in this Opinion would be in effect for the duration of the permits which expire December 31, 2006. One permit modification action will extend the permit from December 31, 2003 to December 31, 2005. Two new permit actions considered in this Opinion would be in effect for five years (i.e., through 2007) and one would be in effect for 3 years (i.e., through 2005).

When a permit holder[1] does not expect to unintentionally kill any juvenile PS chinook salmon during the course of his or her work, NMFS normally sets an unintentional mortality figure at two percent of expected take. The reason for this is that on occasion unforseen circumstances can arise and, based on years of research experience, NMFS has determined it is best in these instances to include modest overestimates of expected take. By doing this, NMFS gives researchers enough flexibility to make in-season research protocol adjustments in response to annual fluctuations in environmental conditions—such as water flows, larger than expected run sizes, etc.—without having to shut down the research because the expected take was exceeded. Also, high take estimates are useful when NMFS analyzes the effects of the actions, allowing accidents that could cause higher-than-expected takes to be included in the analysis.

Research permits list conditions to be followed before, during, and after the research activities are conducted. These conditions are intended to: (a) ensure compliance with the ESA; (b) manage the interaction between scientists by requiring coordination of research activities among permit holders and between permit holders and NMFS; (c) require measures to minimize impacts on target species; (d) and report information to NMFS on the nature and impact of the research activities on the species of concern.

ESA Section 10(a)(1)(A) Scientific Research Permit Terms and Conditions

The following conditions will be in all permits and permit modifications. In all cases, the permit holder must:

1. The permit holder must ensure that listed species are taken only at the levels, by the means, in the areas and for the purposes stated in the permit application, and according to the terms and conditions in this permit.

[1] Permit Holder means the permit holder, any employee, contractor or agent of the permit holder.

2. The permit holder must not intentionally kill or cause to be killed any listed species unless the permit specifically allows intentional lethal take.

3. The permit holder must handle listed fish with extreme care and keep them in cold water to the maximum extent possible during sampling and processing procedures. When fish are transferred or held, a healthy environment must be provided; e.g., the holding units must contain adequate amounts of well-circulated water. When using gear that captures a mix of species, the permit holder must process listed fish first to minimize handling stress.

4. The permit holder must stop handling listed juvenile fish if the water temperature exceeds 70 degrees Fahrenheit at the capture site. Under these conditions, listed fish may only be visually identified and counted.

5. If the permit holder anesthetizes listed fish to avoid injuring or killing them during handling, the fish must be allowed to recover before being released. Fish that are only counted must remain in water and not be anesthetized.

6. The permit holder must use a sterilized needle for each individual injection when passive integrated transponder tags (PIT-tags) are inserted into listed fish.

7. If the permit holder incidentally captures any listed adult fish while sampling for juveniles, the adult fish must be released without further handling and such take must be reported.

8. The permit holder must exercise care during spawning ground surveys to avoid disturbing listed adult salmonids when they are spawning. Researchers must avoid walking in salmon streams whenever possible, especially where listed salmonids are likely to spawn. Visual observation must be used instead of intrusive sampling methods, especially when just determining presence of anadromous fish.

9. The permit holder using backpack electrofishing equipment must comply with NMFS' Backpack Electrofishing Guidelines (June 2000) available at http://www.nwr.noaa.gov/1salmon/salmesa/4ddocs/final4d/electro2000.pdf.

10. The permit holder must obtain approval from NMFS before changing sampling locations or research protocols.

11. The permit holder must notify NMFS as soon as possible but no later than 2 days after any authorized level of take is exceeded or if such an event is likely. The permit holder must submit a written report detailing why the authorized take level was exceeded or is likely to be exceeded.

12. The permit holder is responsible for any biological samples collected from listed species as long as they are used for research purposes. The permit holder may not transfer biological

samples to anyone not listed in the application without prior written approval from NMFS.

13. The person(s) actually doing the research must have a copy of this permit while conducting the authorized activities.

14. The permit holder must allow any NMFS employee or representative to accompany field personnel while they conduct the research activities.

15. The permit holder must allow any NMFS employee or representative to inspect any records or facilities related to the permit activities.

16. The permit holder may not transfer or assign this permit to any other person as defined in Section 3(12) of the ESA. This permit ceases to be in effect if transferred or assigned to any other person without NMFS' authorization.

17. NMFS may amend the provisions of this permit after giving the permit holder reasonable notice of the amendment.

18. The permit holder must obtain all other Federal, state, and local permits/authorizations needed for the research activities.

19. On or before January 31th of every year, the permit holder must submit to NMFS a post-season report in the prescribed form describing the research activities, the number of listed fish taken and the location, the type of take, the number of fish intentionally killed and unintentionally killed, the take dates, and a brief summary of the research results. Falsifying annual reports or permit records is a violation of this permit.

20. If the permit holder violates any permit term or condition they will be subject to any and all penalties provided by the ESA. NMFS may revoke this permit if the authorized activities are not conducted in compliance with the permit and the requirements of the ESA or if NMFS determines that its ESA section 10(d) findings are no longer valid.

Additional permit conditions specific to each of the proposed research are included in the descriptions of the respective permits.

Some of the activities identified in the proposed permit actions will be funded by NMFS, the COE, the USFWS, and the EPA. These agencies are also responsible for complying with section 7 of the ESA because they are funding activities that may affect listed species, therefore this consultation examines the activities they propose to fund and thus will fulfill their section 7 consultation requirements.

Finally, NMFS will monitor actual annual takes of ESA-listed fish species associated with scientific research activities, by requiring annual reports or by other means, and shall adjust annual permitted take levels if they are deemed to be excessive or if cumulative take levels are determined to operate to the disadvantage of the ESA-listed species.

The Individual Permits

Table 1 displays the permits, overall amounts of take being requested in each permit application, the general actions with which that take would be associated, and general location of research activities. "Take" is defined in section 3 of the ESA; it means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect or to attempt to engage in any such conduct. The table's purpose is to depict the total impact—strictly in terms of pure take numbers—that can be expected from the proposed research activities. Detailed, action-by-action breakdowns (i.e., how much take is associated with each activity in each permit) are found in the Determination of Effects section.

Permit Modifications/Amendments

Permit 1309 - KCDNRP

The KCDNRP in Seattle, Washington requests a modification (modification 2) to its permit for increased annual take of juvenile threatened naturally produced PS chinook salmon associated with its current study examining the behavior of juvenile chinook and other salmonids in the Green/Duwamish watershed and adjacent nearshore areas in the state of Washington. In addition, the KCDNRP proposes to expand their work to Elliot Bay. The study will provide information about natural chinook salmon growth, timing of migration, feeding, life history types and interactions with hatchery salmon. Resource managers will use the information to take short-term conservation measures as well as to establish a baseline to gauge the long-term effectiveness of ESA recovery actions. The KCDNRP also requests authorization to intentionally kill PS chinook salmon for otolith and diet analysis and to capture listed fish using a screw and Onieda fish trap. In addition to all other conditions, the following Special Condition will be included in Permit 1309:

- If any ESA-listed juvenile fish are unintentionally killed during these activities they must be used in place of intentional mortalities.

Permit 1315 - The COE

The COE in Seattle, Washington requests a modification (modification 2) to its permit, which authorizes annual take of PS chinook salmon under several studies. The COE is proposing to

micro-acoustic tag naturally produced PS chinook salmon associated with an
Table 1. Summary of the proposed Research Permits Considered in this Biological Opinion.

*Intentional mortality means fish that are killed on purpose as part of the research; unintentional mortality means fish that are killed by accident when the research is conducted.

Permit No.	Take Requested (per year) Juvenile, Naturally produced PS Chinook Salmon	Take Requested (per year) Juvenile, Artificially propagated PS Chinook Salmon	Take Requested (per year) Adult Naturally produced and Artificially propagated PS Chinook Salmon	Proposed Types of Take	Location Washington State
1140	250 Study 1	50 Study 1		Intentional Mortality	Duwamish Waterway
	350 Study 2	150 Study 2		Intentional Mortality	Puget Sound
	350 Study 2	150 Study 2		Handle/Stomach Analysis/ Release	
	1,000 Study 2	500 Study 2		Handle/Measure/Release	
	1,950	**850**		**Total Take Requested**	
1156	5	5		Handle/Release	Puget Sound
	5	**5**		**Total Take Requested**	
1309	60,000			Handle/Mark/Release	Green/Duwamish Watershed and Elliot Bay
	1,040			Intentional Mortality	
	61,040			**Total Take Requested**	
1315	412 Study 8			Handle/Stomach Analysis/ Release	Ship Canal and Lakes Washington and Sammamish,
	147 Study 8			Handle/Mark/Release	
	75 Study 8			Handle/Release	
	15 Study 8			Unintentional Mortality	
	649			**Total Take Requested**	
1376	196		3	Handle/Stomach Analysis/ Release	Lakes Washington and Sammamish
	13			Unintentional Mortality	
	209		**3**	**Total Take Requested**	

ongoing investigation of fish passage conditions at the large lock chamber of the Hiram M. Chittenden Locks and Lake Washington Ship Canal in the state of Washington. In addition, the COE is requesting authorization to subsample a number of juvenile chinook captured for stomach content analysis using non-lethal evacuation. The study will identify effects of the fish passage conditions on salmonids in the Lake Washington Basin and help researchers (1) identify limiting factors contributing to smolt survival, (2) develop smolt survival estimates, and (3) assess restoration measures to improve smolt survival.

Further, the COE is requesting annual take of juvenile threatened naturally produced PS chinook salmon associated with a new study (study 8) which will provide it and the city of Seattle with information on salmonid nearshore habitat use in Lake Washington and the Lake Washington Ship Canal. The information will help (1) determine the relationship between habitat use and shoreline development, (2) guide the city's habitat restoration efforts to improve habitat conditions, (3) help predict the effects of modifications to salmonid habitat, and (4) and aid Lake Washington area municipalities with their shoreline management programs. Listed fish would be captured by beach seine, anesthetized, sampled for biological information and stomach contents using non-lethal evacuation, tagged/marked, and released.

Permit 1376 - UW

The UW in Seattle, Washington requests a modification (modification 1) to its permit for increased annual take of juvenile naturally produced PS chinook salmon associated with research to be conducted in Lakes Washington and Sammamish. In addition, the UW is requesting to extend the permit action through December 31, 2005. The purpose of the research is to understand food web interactions, identify sources of mortality, and determine the energetic requirements to sustain fish and zooplankton communities in each lake. The study will help researchers identify and quantify factors limiting survival and growth of juvenile salmon and other species. The UW proposes to capture (using gillnets, trawls, hook-and-line, trot lines, minnow traps, beach seines, and backpack electrofishing equipment), anesthetize, handle, measure, weigh, and release juvenile PS chinook salmon and examine the stomach contents of juvenile chinook salmon using non lethal evacuation.

Proposed New Permits

Permit 1140 - NWFSC

The NWFSC in Seattle, Washington requests a permit for three studies that will have annual take of several listed ESUs; however, this Opinion will analyze only the following two activities affecting PS chinook salmon. Separate Opinions will address the take associated with the other study.

Study 1. The NWFSC would take listed juvenile PS chinook salmon while conducting research activities in the Duwamish waterway in the state of Washington. The NWFSC will investigate salmon exposure to contaminants and evaluate the extent of river contamination to determine what actions will be necessary to mitigate future exposure. Beach seines will be used to catch juvenile threatened PS chinook salmon. The NWFSC also would collect samples with high speed rope trawls and it requests authorization to lethally take salmon for contaminant analysis.

Study 2. The NWFSC would take juvenile PS chinook salmon associated with an assessment and monitoring program designed to (1) characterize the estuarine ecology of existing life history types of chinook salmon, (2) evaluate the performance of estuarine habitat restoration actions, and (3) evaluate the effects of shoreline alterations on nearshore fishes. Sampling will occur in Seattle, Washington's estuarine nearshore areas. The NWFSC would collect listed salmon with beach seines, enclosure nets, surface trawl nets, and block/fyke nets, sample the fish for biological data and stomach contents using non-lethal evacuation, and then release them. In addition, the NWFSC requests authorization to intentionally kill salmon for histopathological attributes and otolith stomach content analyses.

In addition to all other conditions, the following Special Condition will be included in Permit 1140:

- If any ESA-listed juvenile fish are unintentionally killed during these activities they must be used in place of intentional mortalities.

Permit 1156 - Dynamac/EPA

The Dynamac/EPA in Corvallis, Oregon requests a permit for the following study that will have annual take of several listed ESUs; however, this Opinion will analyze only those studies affecting PS chinook salmon. Separate Opinions will address the take of the other ESUs associated with this study.

The Dynamac/EPA would take juvenile naturally produced and artificially propagated PS salmon associated with research designed to assess species status and trends in randomly-selected river systems in Oregon, Washington, and Idaho. The Dynamac/EPA intends to conduct annual surveys for fish, macroinvertebrate, algae, and microbial assemblages as well as physical and chemical habitat conditions in randomly selected river-systems in Oregon, Washington, and Idaho. Listed fish will be captured by electrofishing (using backpack or raft-mounted gear), sampled for biological information, and released. The research will benefit the listed species by providing baseline information about water quality in the study areas and will also support enforcement of the Clean Water Act in those river systems where listed fish are present. Dynamac Corporation, U.S. Geological Survey Biological Resources Division, Idaho Department of Environmental Quality, and Washington Department of Ecology will be cooperators in the proposed EPA research. The EPA requests the cooperators' biologists be authorized as agents of the EPA in conducting the research.

The Action Area

The action area for this consultation includes all marine, estuarine and river reaches accessible to listed chinook salmon in Puget Sound. Researchers will conduct their activities throughout this area. Accessible reaches are those within the historical range of the ESU that can still be occupied by any life stage of salmon or steelhead. Puget Sound marine areas include South Sound, Hood Canal, and North Sound to the international boundary at the outer extent of the Strait of Georgia, Haro Strait, and the Strait of Juan de Fuca to a straight line extending north from the west end of Freshwater Bay, inclusive. Also included are adjacent riparian zones. Excluded are tribal lands and areas above specific dams or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years). Major river basins containing spawning and rearing habitat for this ESU comprise approximately 13,761 square miles in Washington. The following counties lie partially or wholly within these basins (or contain migration habitat for the species): Clallam, Grays Harbor, Island, Jefferson, King, Kitsap, Lewis, Mason, Pierce, San Juan, Skagit, Snohomish, Thurston, and Whatcom.

STATUS OF THE SPECIES UNDER THE ENVIRONMENTAL BASELINE

To qualify for listing as a threatened species, PS chinook salmon must constitute "species" under the ESA. The ESA defines a "species" to include any "any subspecies of fish, wildlife, or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature." On November 20, 1991, NMFS published a policy (56 FR 58612) describing the agency's application of the ESA definition of "species" to Pacific salmonid species. This policy provides that a Pacific salmonid population will be considered distinct, and hence a species under the ESA, if it represents an ESU of the biological species. The population must satisfy two criteria to be considered an ESU: (1) It must be reproductively isolated from other conspecific population units, and (2) it must represent an important component in the evolutionary legacy of the biological species. The first criterion, reproductive isolation, need not be absolute, but must be strong enough to permit evolutionarily important differences to accrue in different population units. The second criterion would be met if the population contributed substantially to the ecological/genetic diversity of the species as a whole. Further guidance on the application of this policy is contained in "Pacific salmon (*Oncorhynchus* spp.) and the Definition of Species under the ESA" (Waples, 1991) and a NOAA Technical Memorandum "Definition of 'Species' Under the Endangered Species Act: Application to Pacific Salmon" (NMFS/NWC-1994).

Status of PS Chinook Salmon

On March 24, 1999, NMFS listed PS chinook salmon, both naturally produced and artificially propagated fish, as a threatened species (64 FR 14308). The ESU encompasses all naturally spawned populations of chinook salmon from rivers and streams flowing into Puget Sound including the Straits of Juan De Fuca from the Elwha River, eastward, including rivers and streams flowing into Hood Canal, South Sound, North Sound and the Strait of Georgia in Washington. NMFS also listed chinook salmon (and their progeny) from the following hatchery stocks because they were considered essential to the recovery of the ESU: Kendall Creek (spring run); North Fork Stillaguamish River (summer run); White River (spring run); Dungeness River (spring run); and Elwha River (fall run).

The PS chinook salmon were listed as threatened under the ESA because NMFS determined that a number of factors—both environmental and demographic—had caused them to decline to the point where within the foreseeable future they were likely to be in danger of going extinct. These factors for decline affect their biological requirements at every stage of their lives and they arise from a number of different sources. This section of the Opinion explores those effects and defines the context within which they take place and provides information about their current status.

PS Chinook Salmon Life History

Chinook salmon in this ESU exhibit an "ocean type" life history (i.e., they emigrate to the ocean as subyearlings). While some spring- and summer-run populations in this ESU have a high proportion of yearling smolt emigrants, the proportion appears to fluctuate considerably from year to year. Populations in this ESU tend to mature at ages 3 and 4. Juvenile life stages (i.e., eggs, alevins, fry, and parr) inhabit freshwater/riverine areas through-out the range of the ESU. Parr usually undergo a smolt transformation as subyearlings in the spring at which time they migrate to the ocean. Subadults and adults forage in coastal and offshore waters of the North Pacific Ocean prior to returning to spawn in their natal streams. Adult spring-run chinook salmon in this ESU typically return to fresh water in April and May and spawn in August and September. In contrast, summer-run chinook salmon return in June and spawn in September, while summer/fall-run fish begin to return in August and spawn from late September through January. Hatchery chinook salmon are also distributed within the range of this ESU, and as noted above under "Status of PS Chinook Salmon," several of these are listed under the ESA as part of the ESU.

Overview—Status of the PS Chinook Salmon

To determine a species' status under extant conditions (usually termed "the environmental baseline"), it is necessary to ascertain the degree to which the species' biological requirements are being met at the time of the proposed action and in that action area. For the purposes of this consultation, PS chinook salmon's biological requirements are expressed in two ways: population parameters such as fish numbers, distribution, and trends through-out the action area; and the condition of various essential habitat features such as water quality, substrate condition, and food availability. Clearly, these two types of information are interrelated; the condition of a given habitat has a great deal of impact on the number of fish it can support. Nonetheless, it is useful to separate the species' biological requirements into these parameters because doing so is a good way to get a full picture of all the factors affecting PS chinook and HCS chum salmon survival and their response to those factors. Therefore, the discussion to follow will be divided into two parts: (1) Species Distribution and Trends and (2) Factors Affecting the Environmental Baseline.

PS Chinook Salmon Distribution and Trends

NMFS has performed little formal modeling of extinction risk for the Puget Sound chinook ESU. However, the March 24, 1999 (64 FR 14308), listing determination and supporting species status reviews (NMFS, 1998a; NMFS, 1998b) provide relevant and recent information regarding the ESU's status. Based on the total Puget Sound catch in 1908 (when both ocean harvest and hatchery production were negligible), Bledsoe et al. (1989) estimated an historical abundance of

670,000 chinook salmon in this ESU. This estimate, as with other historical estimates, should be viewed cautiously. Puget Sound cannery pack probably included a portion of fish landed at Puget Sound ports but originating in adjacent areas, and cannery pack represents only a portion of the total catch.

Recent spawning escapement data for this ESU are summarized in Table 2 which addresses the WDFW and Tribal resource managers 15 chinook salmon "management units" (WDFW and PSIT, 2001) encompassing all listed chinook salmon populations in the Puget Sound ESU: (1) Nooksack early, (2) Skagit spring, (3) Skagit summer/fall, (4) Stillaguamish summer/fall, (5) Snohomish, (6) Lake Washington summer/fall,(7) Green summer/fall, (8) White River, (9) Puyallup, (10) Nisqually, (11) Mid-Hood Canal, (12) Skokomish, (13) Dungeness, (14) Elwha, and (15) Western Strait. Throughout this document the reporting information—including maps—is organized by the watersheds defined by USGS Hydrologic Unit Code (HUC) (Figure 1) which encompass these "management units."

It is possible to make only rough estimates of the number of adults and juveniles in this ESU during the coming five years. Escapement estimates compiled since 2000 (Bruce Sanford, WDFW. Pers. Comm. to C. Bill, Feb. 25, 2003) indicate that between 41,000 and 57,000 naturally-produced chinook salmon have escaped to spawn in the range of the 15 management units (WDFW and PSIT, 2001). Using these previous years' estimates, it is likely that future adult returns will number in the tens of thousands of adult fish if conditions remain similar to those of recent years. While we currently lack data on naturally produced juvenile chinook salmon production for this ESU, it is possible to make rough estimates of juvenile abundance from adult return data. NMFS (1998a) reviewed fecundity estimates for several Puget Sound chinook salmon populations; average fecundity ranged from 4,063 to 7,861 eggs per female. By applying a conservative 4,000 eggs per female value to the estimated 20,500 females returning (half of 41,000) to this ESU, approximately 82 million eggs may be expected to be produced annually. Published estimates of survival from egg to smolt are few and variable but have been estimated to average around 10% (Healey, 1991). Thus, we can make a rough estimate of 8.2 million juvenile chinook salmon in the Puget Sound basin.

Though escapement trends have turned positive for many populations, 10 of these populations are influenced by hatchery production (WDFW and PSIT, 2001). Table 3 shows the known spawning aggregations of chinook salmon within the Puget Sound ESU by Geographic area. Nomenclature follows that described in the Salmon and Steelhead Stock Inventory (SASSI) document (WDF et al., 1993).

The distribution of negative and positive population trends is very uneven in Puget Sound. The positive trends are associated with populations having high hatchery influence, while negative trends are found in populations supported primarily by natural production. These data and others (e.g., declining recruit/spawner ratios in Skagit River populations) continue to raise serious concerns about the sustainability of natural chinook salmon populations in Puget Sound.

Table 2. Spawning escapements (WDFW and PSIT, 2001) and juvenile outmigration estimates for Puget Sound natural chinook management units based on preliminary 2002 escapement estimates.

Geographic Area/ Management Unit	2000	2001	2002	Outmigration estimates (2003)*
Nooksack/Samish	**1525**	**2453**	**3969**	79,380
North Fork	1242	2185	3687	
South Fork	283	268	282	
Skagit	**17951**	**15649**	**20656**	4,131,200
Skagit spring	1021	1856	1065	
Skagit summer/fall	16930	13793	19591	
Stillaguamish	**1622**	**1349**	**1588**	31,760
Stillaguamish summer/fall	1622	1349	1588	
Snohomish	**6092**	**8164**	**7220**	1,444,000
Snohomish /skykomish	4665	4575	4325	
Snoqualmie	1427	3589	2895	
Lake Washington	**347**	**1269**	**637**	127,400
Cedar River	120	810	369	
North Lake Washington	227	459	268	
Green/Duwamish	**6170**	**7975**	**13950**	2,790,000
Green River fall	6170	7975	13950	
Puyallup	**2761**	**3915**	**2393**	478,600
White River spring	1523	2000	803	
Puyallup fall	1193	1915	1590	
Nisqually	**1253**	**1079**	**1542**	308,400
Nisqually fall	1253	1079	1542	
Hood Canal	**1281**	**2136**	**1574**	314,800
Mid Hood Canal	438	342	95	
Skokomish	843	1794	1479	
Dungeness/Elwha	**2787**	**3607**	**3725**	745,000
Dungeness	128	453	663	
Elwha River	1959	2208	2376	
Hoko	700	946	686	

*Outmigration estimates are based on the number of spawning female escapements and the estimated survival rate from egg to smolt.

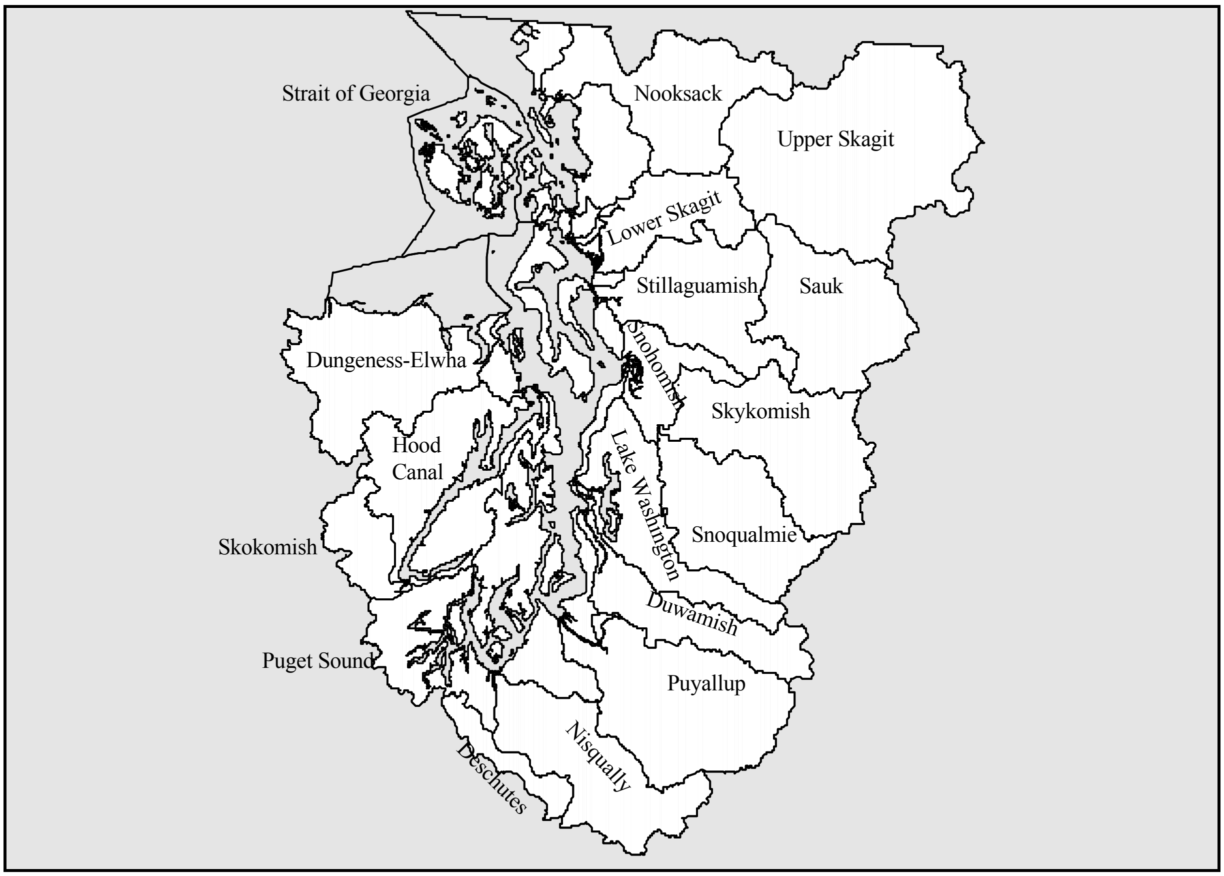

Figure 1. Watershed basins and drainages defined by USGS Hydrologic Unit Code (HUC).

Table 3. Known spawning aggregations of chinook salmon within the Puget Sound ESU by Geographic area.

Geographic Area	SASSI stock	Spawning aggregation
Nooksack/Samish	North Fork Nooksack	mainstem
		lower middle Fork Nooksack River
		Maple Creek
		Canyon Creek
		Cornell Creek
		Boyd Creek
		McDonald Creek
	Samish/Mainstem Nooksack fall	mainstem Nooksack River
		Samish
Skagit	Upper Skagit mainstem/tribs summer	mainstem
		llabot Creek
		Bacon Creek
		Falls Creek
		Goodell Creek
		Clark Creek
		Diobsud Creek
	Lower Skagit mainstem/tribs fall	mainstem
	Lower Sauk summer	mainstem
	Upper Sauk spring	mainstem
		White Chuck River
		South Fork Sauk River
	Suiattle spring	Mainstem
		Sulphur Creek
		Buck Creek
		Big Creek
		Lime Creek
	Upper Cascade spring	mainstem
Stillaguamish	Stillaguamish summer	North Fork Stillaguamish River
		Boulder River
	Stillaguamish fall	South Fork Stillaguamish River
		mainstem Stillaguamish River
		Jim Creek
		Canyon Creek
Snohomish	Snohomish summer	mainstem Snohomish
		mainstem Skykomish
	Wallace summer/fall	mainstem
	Snohomish fall	Snoqualmie River
		Sultan River
		Pilchuck River
		Woods Creek
		Elwell Creek
		Tolt River
	Bridal Veil Creek fall	Bridal Veil Creek
		South Fork Skykomish River
		North Fork Skykomish River
Lake Washington	Issaquah	Issaquah Creek
		East Fork Issaquah Creek
	North Lake Washington tribs	North Creek

Table 3 (Continued).

Geographic Area	SASSI stock	Spawning aggregation
		Swamp Creek
		Bear Creek
		Little Bear Creek
		Thornton Creek
		McAleer Creek
		Cottage Lake Creek
		Sammamish River
	Cedar summer/fall	mainstem
Duwamish/Green	Duwamish/Green summer fall	Duwamish River
		Green River
		Newaukum Creek
Puyallup	White (Puyallup) spring	mainstem
		Clearwater River
		Greenwater River
		West Fork White River
	White (Puyallup) summer/fall	Mainstem
	Puyallup fall	mainstem
		South Prairie Creek
		Carbon River
Nisqually	Nisqually summer/fall	Mainstem
		Ohop Creek
		Mashel River
South Sound	South Sound tributaries summer/fall	McAllister Creek
		Grovers Creek
		Gorst Creek
		Chambers Creek
		Carr Inlet streams
		Deschutes River
Hood Canal	Hood Canal	Skokomish River
		Hamma Hamma River
		Dosewallips River
		Duckabush River
		Union River
		Tahuya River
		Dewatto River
Strait of Juan de Fuca	Dungeness spring/summer	mainstem
		Gray Wolf River
	Elwha/Morse Creek summer/fall	Elwha River
		Morse Creek

Factors Affecting the Environmental Baseline

Environmental baselines for biological opinions are defined by regulation at 50 CFR 402.02, which states that an environmental baseline is the physical result of all past and present state, Federal, and private activities in the action area along with the anticipated impacts of all proposed Federal projects in the action area (that have already undergone formal or early section 7 consultation). The environmental baseline for this biological opinion is therefore the result of the impacts that many activities (summarized below) have had on PS chinook salmon's survival and recovery. The baseline is the culmination of these effects on these species' biological requirements and, by examining those individual effects, it is possible to derive the species' status in the action area.

The biological requirements for PS chinook salmon in the action area can best be expressed in terms of the essential features of their habitat. That is, the salmon require adequate: (1) substrate (especially spawning gravel), (2) water quality, (3) water quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) food, (8) riparian vegetation, (9) space, and (10) migration conditions (65 FR 7764). The best scientific information presently available demonstrates that a multitude of factors, past and present, have contributed to the decline of west coast salmonids by adversely affecting these essential habitat features. NMFS reviewed much of that information in its recently completed Consultation (NMFS, 2002a). That review is summarized in the sections below.

Human-Induced Habitat Degradation

Bishop and Morgan (1996) identified a variety of habitat issues for streams in the range of this ESU because of urbanization forest and agricultural practices including (1) changes in flow regime (all basins), (2) sedimentation (all basins), (3) high temperatures (Dungeness, Elwha, Green/Duwamish, Skagit, Snohomish, and Stillaguamish Rivers), (4) streambed instability (most basins), (5) estuarine loss (most basins), (6) loss of large woody debris (Elwha, Snohomish, and White Rivers), (7) loss of pool habitat (Nooksack, Snohomish, and Stillaguamish Rivers), and (8) blockage or passage problems associated with dams or other structures (Cedar, Elwha, Green/Duwamish, Snohomish, and White Rivers). Further, aquaculture practices have played a role in degrading riverine and estuarine habitats. These activities and habitat modifications have greatly degraded extensive areas of salmon spawning and rearing habitat in the Puget Sound. The rising population density in parts of Washington will continue to adversely affect the quality and quantity of local water resources for chinook salmon.

To counteract all the negative effects listed in this section, Federal, state, tribal, and private entities have—singly and in partnership—begun recovery efforts to help slow and, eventually, reverse the decline of salmon and steelhead populations. Notable efforts within the range of PS chinook are the Wild Stock Restoration Initiative, Joint Wild Salmonid Policy, Shorelines

Management Act, and the Northwest Forest Plan. Nevertheless, despite these efforts, much remains to be done to recover these species and other salmonids in the Puget Sound Basin.

Hatcheries

Fall-, summer-, and spring-run chinook salmon stocks are artificially propagated in Puget Sound. Currently, the majority of production is devoted to fall-run (also called summer/fall) stocks for the purpose of enhancing fisheries. Conversely, approximately half of the depressed spring- and summer-run stocks recognized by WDF et al. (1993) are under captive culture or supplementation programs. Captive broodstock/recovery programs for spring-run chinook salmon have been undertaken on the White River (Appleby and Keown, 1994) and the Dungeness River (Smith and Sele, 1995). Supplementation programs currently exist for spring-run chinook salmon on North Fork Nooksack River and for summer-run chinook salmon on the Stillaguamish and Skagit Rivers (Fuss and Ashbrook, 1995; Marshall et al., 1995).

Hatchery fish can harm naturally produced salmon and steelhead in four primary ways: (1) ecological effects, (2) genetic effects, (3) overharvest effects, and (4) masking effects (NMFS, 2000c). Ecologically, hatchery fish can prey upon, displace, and compete with wild fish. These effects are most likely to occur when fish are released in poor condition and do not migrate to marine waters, but rather remain in the streams for extended rearing periods. Hatchery fish also may transmit hatchery-borne diseases, and hatcheries themselves may release disease-carrying effluent into streams. Hatchery fish can affect the genetic composition of native fish by interbreeding with them. Interbreeding can also be caused by humans taking native fish from one area and using them in a hatchery program in another area. Interbred fish are less adapted to the local habitats where the original native stock evolved and may therefore be less productive there.

To address concerns of potential disease transmission from hatchery salmonids and to minimize water quality impacts, comanagers developed a Fish Health Policy and are in compliance with the National Pollutant Discharge Elimination System permit provisions and Pacific Northwest Fish Health Protection Committee's comprehensive fish health protection program.

Harvest

Fisheries in Puget Sound have sometimes been managed poorly because "maximum sustainable yield" rates have been identified incorrectly in light of declining productivity of natural chinook salmon stocks. High harvest rates directed at hatchery stocks have caused many stocks to fail to meet natural escapement goals in most years (USFWS, 1996). Harvest impacts on Puget Sound chinook salmon stocks have been quite high. Salmon are also taken incidentally in the groundfish and whiting fishery off Washington, Oregon, and California (NMFS, 1996).

Co-managers implemented several strategies to manage the recreational harvest. Time/area closures are used to reduce catches of weak stocks in directed fisheries and to reduce chinook bycatch in other fisheries. Other regulations, such as size limits, bag limits, and barbless hooks are also used. Most recently, managers have begun using mass marking and selective fishing practices to protect natural stocks.

Natural Conditions

Recent declines in fish populations in Puget Sound may reflect increased predation and recent climatic shifts. NMFS has noted that predation by marine mammals has increased as marine mammal numbers, especially harbor seals (*Phoca vitulina*) and California sea lions (*Zalophus californianus*) increase on the Pacific Coast (NMFS, 1988). In addition to predation by marine mammals, Fresh (1997) reported that 33 fish species and 13 bird species are predators of juvenile and adult salmon, particularly during freshwater rearing and migration stages.

Changes in climate and ocean conditions happen on several different time scales and have had profound influence on distributions and abundances of marine and anadromous fishes. Recent evidence suggests that marine survival among salmonids fluctuates in response to 20- to 30-year cycles of climatic conditions and ocean productivity (Hare et al., 1999). Although recent climatic conditions appear to be within the range of historical conditions, the risks associated with climatic changes are probably exacerbated by human activities (Lawson, 1993).

Scientific Research

PS chinook salmon, like other ESA-listed fish, are the subject of scientific research and monitoring activities. Most biological opinions issued by NMFS have conditions requiring specific monitoring, evaluation, and research projects to gather information to aid the survival of listed fish. Recently, NMFS issued numerous research permits/authorizations allowing takes of PS chinook (NMFS, 2002a, 2002b) which are summarized in the following table.

Table 4. Total Authorized Take of Threatened PS Chinook Salmon.

	PS CHINOOK SALMON			
	ADULT		JUVENILE	
	NON-LETHAL	LETHAL	NON-LETHAL	LETHAL
SECTION 10 RESEARCH	67	0	71,955	1,229
4(d) RESEARCH	1,100	10	377,264	4,179
TOTAL	1,167	10	449,219	5,408

Each authorization for take by itself would not lead to decline of the species. However the sum of the authorized takes indicate a high level of research effort in the action area. The effect of these activities is difficult to assess because despite the fact that fish are harassed and sometimes even killed in the course of scientific research, these activities have a great potential to benefit to ESA-listed species. For example, aside from simply increasing what is known about the listed species and their biological requirements, research is essentially the only way to answer key questions associated with difficult resource issues that crop up in every management arena and involve every salmonid life history stage (particularly the resource issues discussed in the previous sections). Most importantly, the information gained during research and monitoring activities will help resource managers plan for the recovery of listed species. That is, no rational resource allocation or management decisions can be made without the knowledge to back them up. Further, there is no way to tell if the corrective measures described in the previous sections are working unless they are monitored, and there is no way to design new and better approaches if research is not done.

In any case, scientific research and monitoring efforts (unlike the other factors described in the previous sections) are not considered to be a factor contributing to the decline of PS chinook salmon, and NMFS believes that the information derived from the research activities is essential to their survival and recovery. Nonetheless, fish are harmed during research activities and therefore, to minimize any harm arising from such activities, NMFS imposes conditions in its permits so that permit holders reduce adverse effects including keeping mortalities as low as possible. Researchers are encouraged to use non-listed fish species and hatchery fish instead of listed naturally produced fish when possible. Also, researchers are required to share sampled fish, as well as the results of the scientific research, with other researchers and comanagers in the region as a way to avoid duplicative research efforts and to acquire as much information as possible from the ESA-listed fish sampled. NMFS also works with other agencies to coordinate research and thereby prevent duplication of effort.

For projects that require an ESA section 10(a)(1)(A) permit, applicants provide NMFS with high take estimates to compensate for potential in-season changes in research protocols, accidental catastrophic events, and the annual variability in listed fish numbers. Also, most research projects depend on annual funding and the availability of other resources. So, a specific research project for which take of ESA-listed species is authorized by a permit may be suspended in a year when funding or resources are not available. As a result, the *actual* take in a given year for most research projects, as provided to NMFS in post-season annual reports, is usually less than the authorized level of take in the permits and the related NMFS consultation on the issuance of those permits. Therefore, because actual take levels tend to be lower than authorized takes, the severity of effects to the ESA-listed species to result from the conduct of scientific research activities are usually less than the effects analyzed in a typical research permit consultation.

Summary

The picture of whether PS chinook salmon's biological requirements are being met is clear-cut for habitat-related parameters and for population factors; given all the factors for decline—even taking into account the corrective measures being implemented[2]—it is clear that their biological requirements are currently not being met under the environmental baseline. Their status is such that there must be a significant improvement in the environmental conditions of the species' respective habitats (over those currently available under the environmental baselines). Any further degradation of the environmental conditions would have a significant impact due to the amount of risk the species presently face under the environmental baselines. In addition, there must be considerable improvements to minimize effects due to hydropower dams, incidental and direct harvest, hatchery practices, and unfavorable estuarine and marine conditions.

[2] See the following documents for a summary of conservation efforts: Steelhead Conservation Efforts: A Supplement to the Notice of Determination for West Coast Steelhead Under the Endangered Species Act, August 1996; Coastal Salmon Conservation Working Guidance for Comprehensive Salmon Restoration Initiatives on the Pacific Coast, September 15, 1996; NOAA Technical Memorandum NMFS-NWFSC-42, June 2000, Viable Salmon Populations and the Recovery of Evolutionarily Significant Units.

EFFECTS OF THE ACTION

The purpose of this section is to identify the effects NMFS' issuance of scientific research permits will have on threatened PS chinook salmon. To the extent possible, this will include analyses of effects at the population level. Where information on PS chinook salmon is scarce at the population level (or naturally spawning populations are not presently assigned to an independent population), this analysis assumes that the status of each affected population is the same as the ESU as a whole. Analyses of effects also include hatchery stocks NMFS considers essential to the ESU's recovery. NMFS concluded that five of the hatchery chinook salmon stocks identified as part of the PS chinook salmon ESU should be listed since they are currently essential for its recovery (NMFS, 1999d). The listed hatchery stocks are: Kendall Creek (spring run); North Fork Stillaguamish River (summer run); White River (spring run); Dungeness river (spring run); and Elwha River (fall run). Table 5 summarizes the 2003 hatchery production goals by listed hatchery stocks. This analysis consists of (a) the general effects scientific research activities are known to have (including the effects arising from mitigation efforts) and (b) permit-specific effects.

Evaluating the Effects of the Action

Over the course of several years and numerous ESA section 7 consultations, NMFS developed the following four-step approach for using the ESA Section 7(a)(2) standards to determine what effect a proposed action is likely to have on a given listed species. What follows here is a summary of that approach:

1. Define the biological requirements and current status of each listed species.

2. Evaluate the relevance of the environmental baseline to the species' current status.

3. Determine the effects of the proposed or continuing action on listed species and their habitat.

4. Determine whether the species can be expected to survive with an adequate potential for recovery under (a) the effects of the proposed (or continuing) action, (b) the effects of the environmental baseline, and (c) any cumulative effects—including all measures being taken to improve salmonid survival and recovery. The fourth step above requires a two-part analysis. The first part focuses on the action area and defines the proposed action's effects in terms of the species' biological requirements in that area (i.e., impacts on essential habitat features). The second part focuses on the species itself. It describes the action's impact on individual fish—or populations, or both—and places that impact

Table 5. Listed hatchery stocks. Production goals for 2003.

Brood Stock	**Production Goal***	
	Subyearling	Yearlings
Kendall Creek (spring-run)	5.8 million	100,000
North Fork Stillaguamish River (summer-run)	200,000	N/A
White River (spring-run)	1.35 million	175,000
Dungeness river (spring-run)	2.0 million	N/A
Elwha River (fall-run)	3.85 million	N/A

*Bruce Sanford, NMFS. Pers. Comm. to C. Bill, February 25, 2003.

in the context of the ESU as a whole. Ultimately, the analysis seeks to answer the questions of whether the proposed action is likely to jeopardize a listed species' continued existence or destroy or adversely modify its designated critical habitat.

Critical habitat was designated for PS chinook salmon on February 16, 2000, when NMFS published a final rule in the Federal Register (65 FR 7764). However, the critical habitat designation for PS chinook salmon was vacated and remanded to NMFS for new rulemaking pursuant to a court order in April 2002. In lieu of a new rule designating critical habitat for PS chinook salmon, this consultation will include an evaluation of the effects of the proposed actions on the species' habitat to determine whether those actions are likely to jeopardize the continued existence of the species.

Effects on PS Chinook Salmon Habitat

Previous sections have described the essential features of PS chinook habitat, and depicted its present condition. The discussion here focuses on how those features are likely to be affected by the proposed actions.

Full descriptions of the proposed activities are found in the next section. In general, the activities will be (a) electrofishing using backpack and boat equipment, (b) streamside and snorkel surveys in spawning and rearing habitat, and (c) capturing fish with traps and nets of various types. All of these techniques are minimally intrusive in terms of their effect on habitat. None of them will measurably affect any of the 10 essential fish habitat features listed earlier (i.e., stream substrates, water quality, water quantity, food, streamside vegetation, etc.). Moreover, the proposed activities are all of short duration. Therefore, NMFS concludes that the proposed activities are unlikely to adversely modify or destroy PS chinook salmon habitat.

Effects on PS Chinook Salmon

The primary effects the proposed activities will have on PS chinook salmon will be in the form of intentional "take" (the ESA take definition is given in the section introducing the individual permits) usually in the form of harassment. Harassment generally leads to stress and other sub-lethal effects and is caused by observing, capturing, and handling fish. The ESA does not define harassment nor has NMFS defined this term through regulation. However, the USFWS defines harassment as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to breeding, feeding or sheltering" [50 CFR 17.4]. For the purposes of this analysis, NMFS adopts this definition of harassment.

As Table 1 illustrates, the various proposed activities would cause many types of take, and while it is not clearly perceptible between what constitutes an activity (e.g., electrofishing) and what constitutes a take category (e.g., harm), it is important to keep the two concepts separate. The reason for this is that the effects being measured here are those which the activity itself has on the listed species. They may be expressed in terms of the take categories (e.g., how many PS chinook salmon are harmed, or harassed, or even killed), but the actual mechanisms of the effects themselves (i.e., the activities) are the causes of whatever take arises and, as such, they bear examination. Therefore, the first part of this section is devoted to a discussion of the general effects known to be caused by the proposed activities, regardless of where they occur or what species are involved.

The following subsections constitute a comprehensive list of the types of activities being proposed. Because they would all be carried out by trained professionals using established protocols and have widely recognized specific impacts, each description is broadly applicable to every proposed permit. Researchers do not receive a permit unless their activities (e.g., electrofishing) incorporate NMFS' uniform, pre-established set of mitigation measures.

Observation

For some studies, ESA-listed fish will be observed in-water (i.e., snorkel surveys): direct observation is the least disruptive and simplest method for determining presence/absence of the species and estimating their relative abundance. Its effects are also generally the shortest-lived among any of the research activities discussed in this section. Typically, a cautious observer can obtain data without disrupting the normal behavior of a fish. Fry and juveniles frightened by the turbulence and sound created by observers are likely to seek temporary refuge behind rocks, vegetation, and deep water areas. In extreme cases, some individuals may temporarily leave the particular pool or habitat type when observers are in their area. Researchers minimize disturbance to fish by moving through streams slowly thus allowing ample time for fish to reach escape cover. During some of the research activities discussed below, redds may be visually inspected, but no redds will be walked on. Harassment is the primary form of take associated with these observation activities, and few if any injuries or deaths are expected to occur—particularly in cases where the observation is to be conducted solely by researchers on the stream banks rather than in the water. There is little a researcher can do to mitigate the effects associated with observation activities because those effects are so minimal. In general, all they can do is move with care and attempt to avoid disturbing sediments, gravels, and, to the extent possible, the fish themselves.

Capture/handling

Capturing and handling fish causes them stress—though they typically recover fairly rapidly from the process and therefore the overall effects of the procedure are generally short-lived. The primary contributing factors to stress and death from handling are excessive doses of anesthetic, differences in water temperatures (between the river and wherever the fish are held), dissolved oxygen conditions, the amount of time that fish are held out of the water, and physical trauma. Stress on salmonids increases rapidly from handling if the water temperature exceeds 18°C or dissolved oxygen is below saturation. Fish that are transferred to holding tanks can experience trauma if care is not taken in the transfer process, and fish can experience stress and injury from overcrowding in traps if the traps are not emptied on a regular basis. Debris buildup at traps can also kill or injure fish if the traps are not monitored and cleared on a regular basis. To minimize these effects NMFS requires the measured described on pages 3-8 to be taken. Those measures are the permit conditions.

Based on prior experience with the research techniques and protocols that would be used to conduct the proposed scientific research, no more than five percent of the juvenile salmonids encountered are likely to be killed as an unintentional result of being captured and handled and, in most cases, that figure will not exceed three percent. In addition, it is not expected that more than one percent of the adults being handled will die and in any case, all researchers will follow the mitigation measures described earlier (page 3) thereby keeping adverse effects to a minimum. Finally, any fish unintentionally killed by the research activities in the proposed permits may be retained as reference specimens or used for other research purposes.

Electrofishing

Electrofishing is a process by which an electrical current is passed through water containing fish in order to stun them—thus making them easy to capture. It can cause a suite of effects ranging from simple harassment to actually killing the fish. The amount of unintentional mortality attributable to electrofishing may vary widely depending on the equipment used, the settings on the equipment, and the expertise of the technician. Electrofishing can have severe effects on adult salmonids. Spinal injuries in adult salmonids from forced muscle contraction have been documented. Sharber and Carothers (1988) reported that electrofishing killed 50 percent of the adult rainbow trout in their study. The long-term effects electrofishing has on both juveniles and adult salmonids are not well understood, but long experience with electrofishing indicates that most impacts occur at the time of sampling and are of relatively short duration.

The effects of electrofishing on PS chinook would be limited to the direct and indirect effects of exposure to an electric field, capture by netting, holding captured fish in aerated tanks, and the effects of handling associated with transferring the fish back to the river (see the next subsection for more detail on capturing and handling effects). Most of the studies on the effects of electrofishing on fish have been conducted on adult fish greater than 300 mm in length (Dalbey et al., 1996). The relatively few studies that have been conducted on juvenile salmonids indicate that spinal injury rates are substantially lower than they are for large fish. Smaller fish intercept a smaller head-to-tail potential than larger fish (Sharber and Carothers, 1988) and may therefore be subject to lower injury rates (e.g., Hollender and Carline, 1994; Dalbey et al., 1996; Thompson et al., 1997). McMichael et al. (1998) found a 5.1% injury rate for juvenile MCR steelhead captured by electrofishing in the Yakima River subbasin. The incidence and severity of electrofishing damage is partly related to the type of equipment used and the waveform produced (Sharber and Carothers, 1988; McMichael, 1993; Dalbey et al., 1996; Dwyer and White, 1997). Continuous direct current (DC) or low-frequency ($\leq$30 Hz) pulsed DC have been recommended for electrofishing (Fredenberg, 1992; Snyder, 1992, 1995; Dalbey et al. 1996) because lower spinal injury rates, particularly in salmonids, occur with these waveforms (Fredenberg, 1992; McMichael, 1993; Sharber et al., 1994; Dalbey et al., 1996). Only a few recent studies have examined the long-term effects of electrofishing on salmonid survival and growth (Dalbey et al., 1996; Ainslie et al., 1998). These studies indicate that although some of the fish suffer spinal injury, few die as a result. However, severely injured fish grow at slower rates and sometimes they show no growth at all (Dalbey et al., 1996).

NMFS' electrofishing guidelines (NMFS, 2000c) will be followed in all surveys using this procedure. The guidelines require that field crews be trained in observing animals for signs of stress and shown how to adjust electrofishing equipment to minimize that stress. Electrofishing is used only when other survey methods are not feasible. All areas for stream and special needs surveys are visually searched for fish before electrofishing may begin. Electrofishing is not done in the vicinity of redds or spawning adults. All electrofishing equipment operators are trained by qualified personnel to be familiar with equipment handling, settings, maintenance, and safety. Operators work in pairs to increase both the number of fish that may be seen and the ability to identify individual fish without having to net them. Working in pairs also allows the researcher to net fish before they are subjected to higher electrical fields. Only DC units will be used, and the equipment will be regularly maintained to ensure proper operating condition. Voltage, pulse width, and rate will be kept at minimal levels and water conductivity will be tested at the start of every electrofishing session so those minimal levels can be determined. Due to the low settings used, shocked fish normally revive instantaneously. Fish requiring revivification will receive immediate, adequate care.

The preceding discussion focused on the effects of using a backpack unit for electrofishing and the ways those effects will be mitigated. It should be noted, however, that in larger streams and rivers electrofishing units are sometimes mounted on boats. These units often use more current than backpack electrofishing equipment because they need to cover larger (and deeper) areas and, as a result, can have a greater impact on fish. In addition, the environmental conditions in larger, more turbid streams can limit researchers' ability to minimize impacts on fish. For example, in areas of lower visibility it is difficult for researchers to detect the presence of adults and thereby take steps to avoid them. Because of its greater potential to harm fish, and because NMFS has not published appropriate guidelines, boat electrofishing has not been given a general authorization under NMFS' recent ESA section 4(d) rules. However, it is expected that guidelines for safe boat electrofishing will be in place in the near future. And in any case, all researchers intending to use boat electrofishing will use all means at their disposal to ensure that a minimum number of fish are harmed (these means will include a number of long-established protocols that will eventually be incorporated int NMFS' guidelines).

Tagging/Marking

Techniques such as PIT-tagging (passive integrated transponder tagging), coded wire tagging, fin-clipping, and the use of radio transmitters are common to many scientific research efforts using ESA-listed species. All sampling, handling, and tagging procedures have an inherent potential to stress, injure, or even kill the marked fish. This section discusses each of the marking processes and its associated risks.

A PIT tag is an electronic device that relays signals to a radio receiver; it allows salmonids to be identified whenever they pass a location containing such a receiver (e.g., any of several dams) without researchers having to handle the fish again. The tag is inserted into the body cavity of the fish just in front of the pelvic girdle. The tagging procedure requires that the fish be captured and extensively handled, therefore any researchers engaged in such activities will follow the conditions listed on page 3 of this Opinion (as well as any permit-specific terms and conditions) to ensure that the operations take place in the safest possible manner. In general, the tagging operations will take place where there is cold water of high quality, a carefully controlled environment for administering anesthesia, sanitary conditions, quality control checking, and a carefully regulated holding environment where the fish can be allowed to recover from the operation.

PIT tags have very little effect on growth, mortality, or behavior. The few reported studies of PIT tags have shown no effect on growth or survival (Prentice et al., 1987; Jenkins and Smith, 1990; Prentice et al., 1990). For example, in a study between the tailraces of Lower Granite and McNary Dams (225 km), Hockersmith et al. (2000) concluded that the performance of yearling chinook salmon was not adversely affected by gastrically- or surgically implanted sham radio tags or PIT-tags. Additional studies have shown that growth rates among PIT-tagged Snake River juvenile fall chinook salmon in 1992 (Rondorf and Miller, 1992) were similar to growth rates for salmon that were not tagged (Conner et al., 2001). Prentice and Park (1984) also found that PIT-tagging did not substantially affect survival in juvenile salmonids.

Coded wire tags (CWTs) are made of magnetized, stainless-steel wire. They bear distinctive notches that can be coded for such data as species, brood year, hatchery of origin, and so forth (Nielsen, 1992). The tags are intended to remain within the animal indefinitely, consequently making them ideal for making long-term, population-level assessments of Pacific Northwest salmon. The tag is injected into the nasal cartilage of a salmon and therefore causes little direct tissue damage (Bergman et al., 1968; Bordner et al., 1990). The conditions under which CWTs may be inserted are similar to those required for applying PIT-tags.

A major advantage to using CWTs is the fact that they have a negligible effect on the biological condition or response of tagged salmon; however, if the tag is placed too deeply in the snout of a fish, it may kill the fish, reduce its growth, or damage olfactory tissue (Fletcher et al., 1987; Peltz and Miller, 1990). This latter effect can create problems for species like salmon because they use olfactory clues to guide their spawning migrations (Morrison and Zajac, 1987).

In order for researchers to be able to determine later (after the initial tagging) which fish possess CWTs, it is necessary to mark the fish externally—usually by clipping the adipose fin—when the CWT is implanted (see text below for information on fin clipping). One major disadvantage to recovering data from CWTs is that the fish must be killed in order for the tag to be removed. However, this is not a significant problem because researchers generally recover CWTs from salmon that have been taken during the course of commercial and recreational harvest (and are therefore already dead).

The other primary method for tagging fish is to implant them with radio tags. There are two main ways to accomplish this and they differ in both their characteristics and consequences. First, a tag can be inserted into a fish's stomach by pushing it past the esophagus with a plunger. Stomach insertion does not cause a wound and does not interfere with swimming. This technique is benign when salmon are in the portion of their spawning migrations during which they do not feed (Nielsen, 1992). In addition, for short-term studies, stomach tags allow faster post-tagging recovery and interfere less with normal behavior than do tags attached in other ways.

The second method for implanting radio tags is to place them within the body cavities of (usually juvenile) salmonids. These tags do not interfere with feeding or movement. However, the tagging procedure is difficult, requiring considerable experience and care (Nielsen, 1992). Because the tag is placed within the body cavity, it is possible to injure a fish's internal organs. Infections of the sutured incision and the body cavity itself are also possible, especially if the tag and incision are not treated with antibiotics (Chisholm and Hubert, 1985; Mellas and Haynes, 1985).

Fish with internal radio tags often die at higher rates than fish tagged by other means because radio tagging is a complicated and stressful process. Mortality is both acute (occurring during or soon after tagging) and delayed (occurring long after the fish have been released into the environment). Acute mortality is caused by trauma induced during capture, tagging, and release. It can be reduced by handling fish as gently as possible. Delayed mortality occurs if the tag or the tagging procedure harms the animal in direct or subtle ways. Tags may cause wounds that do not heal properly, may make swimming more difficult, or may make tagged animals more vulnerable to predation (Howe and Hoyt, 1982; Matthews and Reavis, 1990; Moring, 1990). Tagging may also reduce fish growth by increasing the energetic costs of swimming and maintaining balance. As with the other forms of tagging and marking, researchers will keep the harm caused by radio tagging to a minimum by following the conditions given on page 3 of this

Opinion, as well as any other permit-specific requirements.

Fin clipping is the process of removing part or all of one or more fins to alter a fish's appearance and thus make it identifiable. When entire fins are removed, it is expected that they will never grow back. Alternatively, a permanent mark can be made when only a part of the fin is removed or the end of a fin or a few fin rays are clipped. Although researchers have used all fins for marking at one time or another, the current preference is to clip the adipose, pelvic, or pectoral fins. Marks can also be made by punching holes or cutting notches in fins, or severing individual fin rays (Kohlhorst, 1979; Welch and Mills, 1981). Many studies have examined the effects of fin clips on fish growth, survival, and behavior. The results of these studies are somewhat variable; however, it can be said that fin clips do not generally alter fish growth. Studies comparing the growth of clipped and unclipped fish generally have shown no differences between them (e.g., Brynildson and Brynildson, 1967). Moreover, wounds caused by fin clipping usually heal quickly—especially those caused by partial clips.

Mortality among fin-clipped fish is also variable. Some immediate mortality may occur during the marking process, especially if fish have been handled extensively for other purposes (e.g., stomach sampling). Delayed mortality depends, at least in part, on fish size; small fishes have often been found to be susceptible to it and Coble (1967) suggested that fish shorter than 90 mm are at particular risk. The degree of mortality among individual fishes also depends on which fin is clipped. Studies show that adipose- and pelvic-fin-clipped coho salmon fingerlings have a 100% recovery rate (Stolte, 1973). Recovery rates are generally recognized as being higher for adipose- and pelvic-fin-clipped fish in comparison to those that are clipped on the pectoral, dorsal, and anal fins (Nicola and Cordone, 1973). Clipping the adipose and pelvic fins probably kills fewer fish because these fins are not as important as other fins for movement or balance (McNeil and Crossman, 1979). Mortality is generally higher when the major median and pectoral fins are clipped. Mears and Hatch (1976) showed that clipping more than one fin may increase delayed mortality, but other studies have been less conclusive.

In addition, any time researchers clip or remove fins, they handle fish. Therefore, the same safe and sanitary conditions required for tagging operations also apply to clipping activities (page 3).

Stomach Flushing

Studies of the food and feeding habits of fish are important in the study of aquatic ecosystems, however food habit studies required researchers to kill fish for stomach removal and examination. Consequently, several methods were developed to remove stomach contents without injuring the fish. Most techniques use a rigid or semi-rigid tube to inject water into the stomach to flush out the contents.

Few assessments of associated mortality rates have been conducted with most nonlethal methods of examining fish stomach contents (Kamler and Pope, 2001). However, the following studies show that stomach flushing does not substantially affect survival in juvenile salmonids. Strange and Kennedy (1981) assessed the survival of salmonids subjected to stomach flushing and found no difference between stomach-flushed fish and control fish that were held for three to five days. In addition, Light et al. (1983) flushed the stomachs of electroshocked and anesthetized brook trout. Survival was 100% for the entire observation period. In contrast, Meehan and Miller (1978) determined the survival rate of electroshocked, anesthetized, and stomach flushed wild and hatchery coho salmon over a 30-day period to be 87% and 84% respectively.

Intentional Mortality/Sacrifice

In some instances, it is necessary to kill a captured fish in order to gather whatever data a study is designed to produce. In such instances, determining the effect is very straightforward: The sacrificed fish, if juveniles, are forever removed from the ESU's gene pool. If the fish are adults, the effect depends upon whether they are killed before or after they have a chance to spawn. If they are killed after they spawn, there is very little overall effect save for removing the nutrients their bodies would have provided to the spawning grounds. If they are killed before they spawn, not only are they removed from the ESU, but so are all their potential progeny. Hence, killing pre-spawning adults has the greatest potential to affect their ESU which NMFS rarely allows this to happen. If it does—it does so in very low numbers. Also the adults are stripped of sperm and eggs so their progeny can be raised in a controlled environment such as a hatchery—thereby greatly decreasing the potential harm posed by sacrificing the adults.

Benefits of Research

Under section 10(d) of the ESA, NMFS is prohibited from issuing a section 10(a)(1)(A) permit unless NMFS finds that the permit (1) was applied for in good faith; (2) if granted and exercised, will not operate to the disadvantage of the endangered and/or threatened species that is/are the subject of the permit; and (3) is consistent with the purposes and policy of section 2 of the ESA. In addition, NMFS does not issue a section 10(a)(1)(A) permit unless the proposed activities are likely to result in a net benefit to the ESA-listed species that is/are the subject of the permit; benefits accrue from the acquisition of scientific information.

For more than a decade, research and monitoring activities conducted with anadromous salmonids in the Pacific Northwest have provided resource managers with a wealth of important and useful information on anadromous fish populations. For example, juvenile fish trapping efforts have enabled the production of population inventories, PIT-tagging efforts have increased the knowledge of anadromous fish migration timing and survival, and fish passage studies have provided an enhanced understanding of fish behavior and survival when moving past dams and through reservoirs. By issuing section 10(a)(1)(A) scientific research permits, NMFS will cause information to be acquired that will enhance the ability of resource managers to make more effective and responsible decisions to sustain anadromous salmonid populations that are at risk of extinction, to mitigate impacts to endangered and threatened chinook salmon and steelhead, and to implement recovery efforts. The resulting data will improve the knowledge of the respective species' life history, specific biological requirements, genetic make-up, migration timing, responses to anthropogenic impacts, and survival in the river system.

Permit-specific Effects

In addition to the effects discussed above, each permits's proposed activities may have additional adverse effects that need to be analyzed. Researchers will use measures required through the permit conditions discussed previously to mitigate such adverse impacts on listed ESUs.

In the "Status of the Species" section both juvenile and adult population abundance is discussed. In the following section NMFS analyzes the impacts of the take numbers in the context of those numbers.

Permit 1140

Permit 1140 would authorize the NWFSC to capture, handle, and release up to 1,350 juvenile naturally produced PS chinook and up to 650 juvenile artificially propagated salmon. In addition the NWFSC proposes to analyze the stomach contents of the juvenile chinook salmon. The permit would also allow the NWFSC to intentionally kill no more than 600 juvenile naturally produced PS chinook salmon and 200 juvenile artificially propagated PS chinook salmon. Sampling activities will occur in the Puget Sound nearshore environments.

NMFS estimates an outmigration of approximately 8.2 million juvenile naturally produced chinook salmon and a production of 13 million juvenile artificially propagated PS chinook salmon. If juvenile PS chinook salmon outmigration and production is typical for future years in Puget Sound, the annual loss of up to 600 juvenile naturally produced PS chinook salmon and 200 juvenile artificially propagated PS chinook salmon associated with the NWFSC's research will not have a measurable impact on either the juvenile population nor on the status of the ESU.

Permit 1156

Permit 1156 would authorize the EPA to capture, handle, and release up to five juvenile naturally produced PS chinook salmon and five juvenile artificially propagated PS chinook salmon. Sampling activities resulting in PS chinook salmon take will occur in in randomly-selected river systems in Washington. The proposed number of fish capture are expected to survive the research actions hence the EPA's actions will not have a measurable impact on the juvenile population nor on the status of the ESU.

Permit 1309

Permit 1309 would authorize the KCDNRP to capture, handle, sample for biological data (length, weight, presence of adipose fin, tissues/scales), mark with elastomer dye, and release up to 60,000 juvenile naturally produced PS chinook salmon. In addition, permit 1309 would allow the KCDNRP to intentionally kill no more than 1,040 juvenile naturally produced PS chinook salmon for otolith and diet analysis.

The research will be conducted in the Green/Duwamish watershed where NMFS roughly estimates an outmigration of approximately 2.7 million juvenile naturally produced chinook. If this outmigration is typical for future years, the annual loss of up to 1,040 juvenile naturally produced PS chinook salmon associated with the KCDNRP's research will not have a measurable impact on the Green/Duwamish juvenile population nor the status of the ESU.

Permit 1315 - modification 2

Permit 1315 would authorize the COE to capture, handle, anesthetize, measure, mark with acrylic dye, sampled for gut contents using non-lethal evacuation and release up to 634 juvenile, naturally produced PS chinook salmon. The permit would also allow the COE to kill no more than 15 juvenile, naturally produced PS chinook salmon as an indirect result of being captured. Sampling activities will occur in the Lake Washington Basin.

NMFS estimates an outmigration of approximately 127,400 juvenile, naturally produced chinook salmon from the Lake Washington Basin. If juvenile, naturally produced chinook salmon outmigration is typical for future years, the annual loss of up to 15 juvenile, naturally produced PS chinook salmon associated with the COE's research (indirect mortalities due to handling) will not have a measurable impact on the Lake Washington juvenile population nor the status of the ESU.

Permit 1376 - modification 1

Permit 1376 would authorize the UW to capture, handle, anesthetize, and release up to 196 juvenile naturally produced PS chinook salmon and three adult PS chinook salmon. The UW proposes to analyze the stomach contents of the juvenile chinook salmon. The permit would also allow the UW to kill no more than 13 juvenile naturally produced PS chinook salmon as an indirect result of being captured. Sampling activities will occur in the Lake Washington Basin.

NMFS estimates an outmigration of approximately 24,000 juvenile naturally produced chinook salmon from the Lake Washington Basin. If juvenile naturally produced chinook salmon outmigration is typical for future years, the annual loss of up to 13 juvenile naturally produced PS chinook salmon associated with the UW's research (indirect mortalities due to handling) will not have a measurable impact on the Lake Washington juvenile population nor the status of the ESU.

Cumulative Effects

Cumulative effects include the effects of future state, tribal, local or private actions (not involving Federal activities) that are reasonably certain to occur within the action area of this consultation. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the Act.

State, tribal and local government actions will likely be in the form of legislation, administrative rules or policy initiatives. Government and private actions may include changes in land and water uses, including ownership and intensity, any of which could impact listed species or their habitat. Government actions are subject to political, legislative and fiscal uncertainties. These realities, added to geographic scope of the action area which encompasses numerous government entities exercising various authorities and the many private landholdings, make any analysis of cumulative effects difficult and frankly speculative. This section identifies representative actions that, based on currently available information, are reasonably certain to occur. It also identifies some goals, objectives and proposed plans by government entities. However, NMFS is unable to determine at this point in time whether any proposals will in fact result in specific actions.

Representative State Actions

The Washington state government is cooperating with other governments to increase environmental protection for listed ESUs, including better habitat restoration, hatchery and harvest reforms, and water resource management. The following list of organizations and initiatives—described in the Summer Chum Salmon Conservation Initiative (WDFW/PNPT, 2000) and Steelhead Conservation Efforts (NMFS, 1996)—are directed at or contributing to the recovery of PS chinook salmon:

- Washington Wildlife and Recreation Program
- Wild Stock Restoration Initiative
- Joint Wild Salmonid Policy
- 1994 - Hood Canal Coordinating Council
- Governor's Salmon Recovery Office

- Conservation Commission
- Salmon Recovery Lead Entities' Program
- Salmon Recovery Funding Board Program
- Forest and Fish Report
- Growth Management Act Programs

There are other proposals, rules, policies, initiatives, and government processes that help conserve marine resources in the Puget Sound, improve the habitat of listed species, and assist in recovery planning that are too numerous to mention. As with the above state initiatives, these programs could benefit the listed species if implemented and sustained.

In the past, Washington state's economy was heavily dependent on natural resources, with intense resource extraction activity. Changes have occurred in the last decade and are likely to continue with less large scale resource extraction, more targeted extraction methods, and significant growth in other economic sectors. Growth in new businesses is creating urbanization pressures and has contributed to population growth and movement in the Puget Sound area, a trend likely to continue for the next few decades. Such trends will place greater demands in the action area for electricity, water and buildable land; will affect water quality directly and indirectly; and will increase the need for transportation, communication and other infrastructure development. These impacts will affect habitat features, such as water quality and quantity, which are important to the survival and recovery of the listed species. The overall effect is likely to be negative, unless carefully planned for and mitigated through the initiatives and measures described above.

Local Actions

Local governments will be faced with similar but more direct pressures from population pressures. There will be demands for intensified development in rural areas as well as increased demands for water, municipal infrastructure and other resources. The reaction of local governments to such pressures is difficult to assess at this time without certainty in policy and funding. In the past local governments in the action area generally accommodated additional growth in ways that adversely affected listed fish habitat allowing for development to destroy wetlands, habitat, etc.

Some local government programs, if submitted, may qualify for a limit under the NMFS' ESA section July 10, 2000, 4(d) rule (50 CFR 223.203) which is designed to conserve listed species. Local governments also may participate in regional watershed health programs, although political will and funding will determine participation and therefore the effect of such actions on listed species. Overall, without comprehensive and cohesive beneficial programs and the sustained application of such programs, it is likely that local actions will have few measurable positive effects on listed species and their habitat, and may even contribute to further degradation.

Tribal Actions

Tribal governments participate in cooperative efforts involving watershed and basin planning designed to improve fish habitat and are expected to continue to do so. In addition, tribal governments manage hatchery and harvest programs that affect listed salmon. The results from changes in tribal forest and agriculture practices, in water resource allocations, and in changes to land uses are difficult to assess for the same reasons discussed under State and Local Actions. The earlier discussions related to growth impacts apply also to tribal government actions. Tribal governments will need to apply comprehensive and beneficial natural resource programs to areas under their jurisdiction to produce measurable positive effects for listed species and their habitat.

Private Actions

The effects of private actions are the most uncertain. Private landowners may convert current use of their lands, or they may intensify or diminish current uses. Individual landowners may voluntarily initiate actions to improve environmental conditions, or they may abandon or resist any improvement efforts. Their actions may be compelled by new laws, or may result from growth and economic pressures. Changes in ownership patterns will have unknown impacts.

Summary

Non-federal actions on listed species are likely to continue affecting listed species. The cumulative effects in the action area are difficult to analyze considering the geographic landscape of this opinion, the uncertainties associated with government and private actions, and the changing economies of the region. Whether these effects will increase or decrease is a matter of speculation; however, based on the trends identified in this section, the adverse cumulative effects are likely to increase. Although state, tribal and local governments have developed plans and initiatives to benefit listed fish, they must be applied and sustained in a comprehensive way before NMFS can consider them reasonably foreseeable in its analysis of cumulative effects.

Integration and Synthesis of Effects

The vast majority (more than 95%) of the juvenile PS chinook salmon that will be “taken” during the course of the proposed research (a total of 64,708 juvenile and three adult fish) and the three adults are expected to survive with no long-term effects. Moreover, most capture, handling, and holding methods will be minimally intrusive and of short duration. Because so many of the captured fish are expected to survive the research actions and so few (a maximum of 0.003% of the total juvenile PS chinook salmon outmigration and a maximum of 0.005% of the total adult PS chinook escapement) will be affected in even the slightest way, it is likely that no adverse effects will result from these actions at either the population or the ESU level.

Table 6. Maximum Annual Takes of Threatened Puget Sound Chinook Salmon

	Adult				Juveniles			
Permit			MORTALITY				MORTALITY	
Action	C,H,R	C,T/M,R	DIRECT	INDIRECT	C,H,R	C,T/M,R	DIRECT	INDIRECT
1140						2,000	800	
1156					10			
1309						60,000	1,040	
1315					75	559		15
1376	3				196			13
Total	3	0	0	0	281	62,559	1,840	28

KEY: C,H,R = Capture, Handle, Release; C,T/M,R = Capture, Tag/Mark, Release

Therefore, adverse effects must be expressed in terms of the individual fish that may be killed during the various permitted activities. The following table summarizes these effects for each permit.

If the total amount of estimated lethal take for all research activities—1,868 juvenile PS chinook salmon—is expressed as a fraction of the 21.2 million fish expected to reach Puget Sound, it represents a loss of 0.009% of the run. However, and for a number of reasons, that number is probably much smaller. First, as stated earlier in the Opinion, the anticipated outmigration of PS chinook salmon is some number larger than the 8.2 million fish and the ESA-listed hatchery fish released exceed 13 million fish. It is impossible to say how much bigger that number would be if we had figures for all of the spawning populations in the Puget Sound Basin, but it is certain that using the 21.2 million figure to represent the entire PS chinook salmon outmigration is a very conservative estimate. Second, it is important to remember to account for potential accidental deaths, that every estimate of lethal take for the proposed studies has purposefully been inflated and it is therefore very likely that fewer than 1,868 juveniles will be killed by the research—possibly fewer. Third, some of the studies will specifically affect PS chinook salmon in the smolt stage, but others will not. These latter studies are described as affecting “juveniles,” which means they may target PS chinook salmon yearlings, parr, or even fry: life stages represented by many more individuals than reach the smolt stage—perhaps as much as an order of magnitude more. Therefore the 0.009% figure was derived by (a) underestimating the actual number of outmigrating PS chinook salmon smolts, (b) overestimating the number of fish likely to be killed, and (c) treating each dead PS chinook salmon as a smolt when some of them clearly won’t be. Thus the actual number of PS chinook salmon the research is likely to kill is undoubtedly smaller than 0.009%—perhaps as little as half (or less) of that figure.

But even if the entire 0.009% of the juvenile PS chinook salmon population were killed, and they were all treated as smolts, it would be very difficult to translate that number into an actual effect on the species. Even if the subject were one adult killed out of a population of one thousand it would be hard to resolve an adverse effect. And in this instance, that effect is even smaller because the loss of a smolt is not equivalent to the loss of an adult in terms of species survival and recovery. This is due to the fact that a great many smolts die before they can mature into adults. Nonetheless, regardless of its magnitude, that negative effect must be juxtaposed with the benefits to be derived from the research (see descriptions of the individual permits). Those benefits range from finding ways to identify and quantify factors limiting survival of juvenile salmon (Permit 1376) to mitigating salmon exposure to contaminants (Permit 1140). In all, the fish will derive some benefit from every permit considered in this Opinion. The amount of benefit will vary, but in some cases it may be significant. For the purpose of section 7(a)(2) NMFS must consider the adverse effects when deciding whether the contemplated actions will appreciably reduce the likelihood of the PS chinook salmon's survival and recovery in the wild—the critical determination in issuing any biological opinion.

Conclusion

After reviewing the current status of threatened PS chinook salmon, the environmental baseline for the action area, the effects of the proposed section 10(a)(1)(A) permit actions, and cumulative effects, it is NMFS' biological opinion that issuance of the proposed permits is not likely to jeopardize the continued existence of threatened PS chinook, nor destroy nor adversely modify their habitat.

Coordination with the National Ocean Service

The activities contemplated in this Biological Opinion will not be conducted in or near a National Marine Sanctuary. Therefore, these activities will not have an adverse effect on any National Marine Sanctuary.

Reinitiation of Consultation

Consultation must be reinitiated if: The amount or extent of annual takes specified in the permits and this consultation is exceeded or is expected to be exceeded; new information reveals effects of the actions that may affect the ESA-listed species in a way not previously considered; a specific action is modified in a way that causes an effect on the ESA-listed species that was not previously considered; or a new species is listed or critical habitat is designated that may be affected by the action (50 CFR 402.16).

MAGNUSON-STEVENS ACT ESSENTIAL FISH HABITAT CONSULTATION

"Essential fish habitat" (EFH) is defined in section 3 of the Magnuson-Stevens Act (MSA) as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." NMFS interprets EFH to include aquatic areas and their associated physical, chemical and biological properties used by fish that are necessary to support a sustainable fishery and the contribution of the managed species to a healthy ecosystem.

The MSA and its implementing regulations at 50 CFR 600.920 require a Federal agency to consult with NMFS before it authorizes, funds or carries out any action that may adversely effect EFH. The purpose of consultation is to develop a conservation recommendation(s) that addresses all reasonably foreseeable adverse effects to EFH. Further, the action agency must provide a detailed, written response NMFS within 30 days after receiving an EFH conservation recommendation. The response must include measures proposed by the agency to avoid, minimize, mitigate, or offset the impact of the activity on EFH. If the response is inconsistent with NMFS' conservation recommendation the agency must explain its reasons for not following the recommendations.

The objective of this consultation is to determine whether the proposed actions, the funding and issuance of scientific research permits under section 10(a)(1)(A) of the ESA for activities within the state of Washington, is likely to adversely affect EFH. If the proposed actions are likely to adversely affect EFH, a conservation recommendation(s) will be provided.

Identification of Essential Fish Habitat

The Pacific Fishery Management Council (PFMC) is one of eight Regional Fishery Management Councils established under the Magnuson-Stevens Act. The PFMC develops and carries out fisheries management plans for Pacific coast groundfish, coastal pelagic species and salmon off the coasts of Washington, Oregon and California. Pursuant to the MSA, the PFMC has designated freshwater and marine EFH for chinook salmon and for several other species (PFMC, 1999). For purposes of this consultation, freshwater EFH for Pacific salmon in Washington includes all streams, lakes, ponds, wetlands, and other water bodies currently or historically accessible to Pacific salmon, except areas upstream of certain impassable dams (as identified by PFMC), and longstanding, naturally-impassible barriers (i.e., natural waterfalls in existence for several hundred years) (PFMC, 1999). Marine EFH for Pacific salmon in Washington, Oregon and California includes all estuarine, nearshore and marine waters within the western boundary of the U.S. Exclusive Economic Zone (EEZ), 200 miles offshore.

Proposed Action and Action Area

For this EFH consultation the proposed actions and action area are as described in detail in the ESA consultation above. The actions are the funding and issuance of a number of scientific research permits pursuant to section 10(a)(1)(A) of the ESA. The proposed action area is the Puget Sound Basin, Washington. A more detailed description and identification of EFH for salmon is found in Appendix A to Amendment 14 to the Pacific Coast Salmon Plan (PFMC, 1999). Assessment of the impacts to these species' EFH from the above proposed action is based on this information.

Effects of the Proposed Action

Based on information submitted by the action agencies and permit applicants, as well as NMFS' analysis in the ESA consultation above, NMFS believes that the effects of this action on EFH are likely to be within the range of effects considered in the ESA portion of this consultation related to habitat effects (page 25). Therefore, NMFS finds that the action will have no adverse effects on essential habitat features.

Conclusion

Using the best scientific information available and based on its ESA consultation above, as well as the foregoing EFH sections, NMFS has determined that the proposed actions are not likely to adversely affect EFH for Pacific salmon.

EFH Conservation Recommendation

NMFS has no conservation recommendations to make in this instance.

Consultation Renewal

The action agencies must reinitiate EFH consultation if plans for these actions are substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for the EFH conservation recommendations (50 CFR Section 600.920(k)).

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